AMENDMENTS TO THE SPECIFICATION

Please amend the identified paragraphs of the specification as follows where added text is indicated by <u>underlining</u>, and deleted text is indicated by ~~strikethrough~~. Changes are identified by a vertical bar in the margin.

Please amend the paragraph on page 1, line 20 through page 2, line 9, as follows:

Presently lithographers adjust the properties of the illumination source (partial coherence, annularity, etc.) to increase the useable processing window. See, for example, "High Throughput Wafer Steppers with Automatically Adjustable Conventional and Annular Illumination Modes", J. Mulkens et al.. As used herein, "illumination source" means the collective effect of the pre-reticle optics (such as mirrors, homogenators, lenses, polarizers, diffusers, etc.) and the light source (mercury arc lamp, excimer laser, synchrotron radiation, etc.) on creating a radiant intensity pattern (energy per unit solid angle) at the reticle. For Kohler Illumination (*see, for example,* "Principles of Optics", M. Born et al., *Pergamon Press,* 524:526), the source on a particular machine, and for a particular machine setting, is completely characterized by the radiant intensity given by:

$$\frac{dE}{do}(nx, ny; x, y) = \text{energy per unit solid angle coming from direction (nx,ny) and at transverse spatial position (x,y) on the reticle} \quad (\text{~~Eq.~~\underline{Equation}} \ 1).$$

Please amend the paragraph on page 17, lines 3-12, as follows:

<u>Further Variations on the Main Embodiments</u>

Figure 22 shows another variation on the 1st embodiment. There the aperture stop, AS, is located between lens L and reticle R on lens plate LP. This can be constructed advantageously if lens center thickness CL and lens radius of curvature, RL are approximately equal. Then the aperture stop is concentric with lens L, the coma is minimized, and the spherical aberration induced by the convex lens top, LT,

will be constant with input ray (source or object) angle. This constant spherical aberration can then be compensated by adjusting lens thickness, CL slightly. Exemplary design parameters for λ = 248.4nm and fused silica lens and reticle material are, RL = 2.12mm, CL = 2.1mm, AG = 0.18mm, RT = 3.81mm with a 0.2mm diameter aperture stop, ~~AG~~AS.

Please amend the paragraph on page 17, line 20 through page 18, line 6, as follows:

Figure 24 shows yet another variation of the 1st main embodiment that allows for telecentric or substantially telecentric operation of in-situ imaging objective, ISIO. Aperture stop, AS, is located in lens top plate, TP, but lens top, LT, is flat while lens bottom, LB, is convex and contains all of the optical power. For telecentric operation, we would have the following paraxial relations:

$$\frac{CL}{n} = \frac{RL}{n-1}$$
(Equation ~~300~~7)

$$\frac{RT}{n} + AG = \frac{RL}{n-1}$$
(Equation ~~301~~8)

Please amend the paragraph on page 18, line 25 through page 19, line 4, as follows:

To the extent that the telecentric constraints of Equations ~~300~~7 and ~~301~~8 do not provide sufficient imaging resolution, they can be relaxed so that (Figure 26) marginal ray bundle MRB and axial ray bundle ARB while not coinciding, stay well within the machine exit pupil, MXP, even at sigma >1 conditions. In this case, correction factor C of Equation 4 will vary and needs to be used for precise correction but to the extent that ARB and MRB stay within the exit pupil boundary, these corrections are relatively minor.

Please amend the paragraph on page 19, lines 5-20, as follows:

Resist Recording Media

When recording the source images in photoresist on a wafer, the process flow of Figure 19 is used. First an MFISIO as described herein is provided and loaded onto the machine we are characterizing. Next a resist coated substrate (wafer) is provided and loaded on the machine. Next, the substrate is exposed at multiple, increasing exposure doses at discretely separated image fields on a wafer See, for example, page 3 of "Examples of Illumination Source Effects on Imaging Performance" by A.J. de Ruyter et. al. in 2003 ARCH Chemicals Microlithography Symposium, *supra*. The substrate is then developed and the exposed images are photographed one by one. From these images and knowledge of the exposure dose sequence, the 'raw' intensity contours of $\frac{dE}{do}(nx, ny)$ are obtained. Next these intensity contours are computationally overlapped and the radiometric and the exit pupil transmission correction factor (Equation 4) are applied to reconstruct the normalized radiant intensity (Figure 21):

$$R(nx, ny; x, y) = \frac{1}{N}\frac{dE}{do}(nx, ny; x, y)$$

(Equation ~~10~~9)

where:

$$N = \int do_n \; \frac{dE}{do}(nx, ny; x, y) \quad \text{the normalization}$$

(Equation ~~11~~10)

Please amend the paragraph on page 20, lines 1-8, as follows:

Electronic Recording Media

If images are recorded electronically (e.g., on a CCD array) instead of in photoresist, the steps outlined in Figure 20 would be followed. The major difference with the previous method is that recorded sensor output directly provides the "raw" intensity or signal for the radiant intensity. Applying any gain offsets or mappings, radiometric (e.g., angle dependant corrections) and exit pupil transmission factor

corrections (Equation 4) are performed to get the normalized radiant intensity (see Equations ~~10~~ 9 and ~~11~~ 10, Figure 21).